Developing Countries and GM Crops

Background

- Projections are that food production currently could feed 6.5 billion (assuming perfectly efficient distribution) but that we will need to feed 9 billion by 2050.
- We therefore need to double food production by 2050 (because of changes in diet in rapidly modernising countries like China).
- Global food deficit predicted for 2020 - a relatively short period interms of scientific advance and technological application.
- Pests and diseases cause up to 40% losses in many tropical crops.
- Cultural and dietary preferences in under producing countries often differs from crops and varieties in over producing countries, e.g. white and yellow maize, and locally within a country e.g. basmati rice in India.
- Grain reserves are historically low in relation to demand.
- There are no major new prime lands for grain production (except possibly the Ukraine). Therefore, increases must come almost entirely from technology.
- The technology challenge is amplified by progressive loss of prime arable land by erosion, desertification and urbanisation and by global climate change and associated uncertainties in environmental concerns.
- Small farmers in many developing countries benefited from the first Green Revolution but not in Sub-Saharan Africa.
- Developing country farmers, breeders and agronomists are not averse to biotechnology- e.g., virus free banana from tissue culture, marker-assisted breeding of rice.
- International Research Institutes, National programmes and Extension services provide networks for transferring technologies attuned to local needs.

What is needed- overview and specific examples

- Conway's article on the small-scale woman farmer and her needs for stress resilient and disease/pest resistant crops, to secure food supply and generate income reliably, even in bad years.
- No available genetic resistance to many pests and pathogens e.g. insect damage in cowpeas, virus infection of crops such as rice, maize, cassava or yams or fungus or nematode diseases of plantain.
- Resilience to adverse environmental conditions- drought, salinity, poor soils, temperature fluctuations.

The Experience so Far
Bt cotton in China, South Africa and India leads the way

- Both Monsanto and Chinese transgenic lines in use in China, Monsanto lines in South Africa and Monsanto-derived lines in India.
- Substantial decrease in the need for pesticide applications.
- Slight increase in yield in China (c. 10%); increased yield in South Africa (up to 80%) and India.
- Increased income to farmers because of reduced input costs and increased yields- in China the difference between modest profits and barely breaking even, in South Africa and India significant profits.
- Less field work for women in South Africa.
- Reduced health problems for farm workers from reduced exposure to pesticides.
- Benefited small-scale farmers; in South Africa pump-priming the economy so that farmers can afford to buy new seed.

- Possibility of developing money-generating associated commercial activities, e.g. local seed industry, product distribution system.

Examples of hurdles to uptake of GM crops

- Release of sweet potato modified to give resistance to feathery mottle virus in Kenya was delayed for many years because of confusion over granting regulatory permission (defect in regulatory structure and impact of European concerns). Although proved effective very slow uptake because of infrastructural defects.
- Attempts to produce transgenic papaya resistant to ringspot virus in South East Asia delayed because of need for characterization of the local strains of virus and inadequate research funding and infrastructure.

Examples of potential of currently available technologies

- Immunization through direct delivery of vaccines- e.g., via banana- efficacy, price, logistics
- Enhanced nutrition- golden rice for vitamin A, alleviation of iron deficiencies etc.
- Resistance to important insect pests and diseases.
- Enhanced agronomic performance for locally preferred varieties where conventional breeding has failed, e.g. semi-dwarf yield gene into Basmati rice.

Potential of emerging technologies and fundamental insights

- The short term major needs are for control of pests and diseases. Many technologies are available or emerging but need to be adapted to specific situations (crops/pests/diseases).
- The longer term needs include resistance to abiotic stresses such as drought and salinity so that poor unproductive land can be used and to adapt crops for post-harvest storage and processing so that the food flow from rural to urban areas is more effective.

Issues

- Preservation of choice in open seed markets and ability of subsistence farmers to save seed if desired. Development of uptake pathways in many countries.
- Renewed investment needed in R&D for poor people's ("orphan crops") crops- cowpea, millet, plantain, cassava, etc.
- Renewed investment needed in research on developing country agronomic problems, e.g., the parasitic weed *Stryga*, environmental stress resilience.
- Creative mechanisms to bridge technology gaps and develop crop R&D capacity in developing countries such as collaboration between industrialized and developing countries capitalizing on their strengths – advanced technologies in industrialized countries and agronomic aspects in developing countries.
- Education of developing country farmers and consumers to create a "pull" environment for the technologies. This should reduce the "hurdles" for the uptake of potentially beneficial technologies.
- Development of robust bio-safety regulations and protocols in developing countries together with stewardship schemes – would involve enhancing extension services that, in turn, would increase farmer education.
- Resolution of impact of GM controversy in Europe.
- Resolution of IP and FTO issues.

References

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